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(54) Abstract Title

Inkjet printable electroluminescent media

(57) An electroluminescent media (50) that can be fed into an inkjet printer and is capable of recording high quality images. The media includes an electroluminescent substrate (60) for generating light, and an ink receiving layer (80). The media assembly can also include feedability controlling layers (90). Electrical contacts (72, 74) can be provided to make the correct electrical connection to the medium to excite the electroluminescence characteristics.

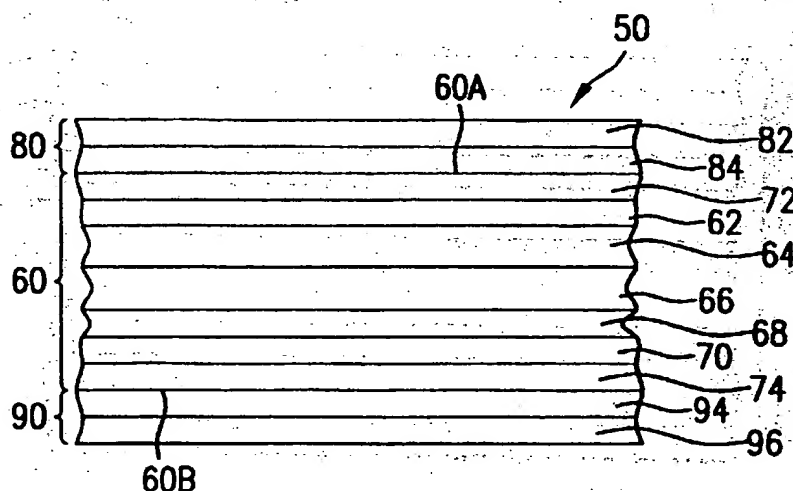


FIG.2

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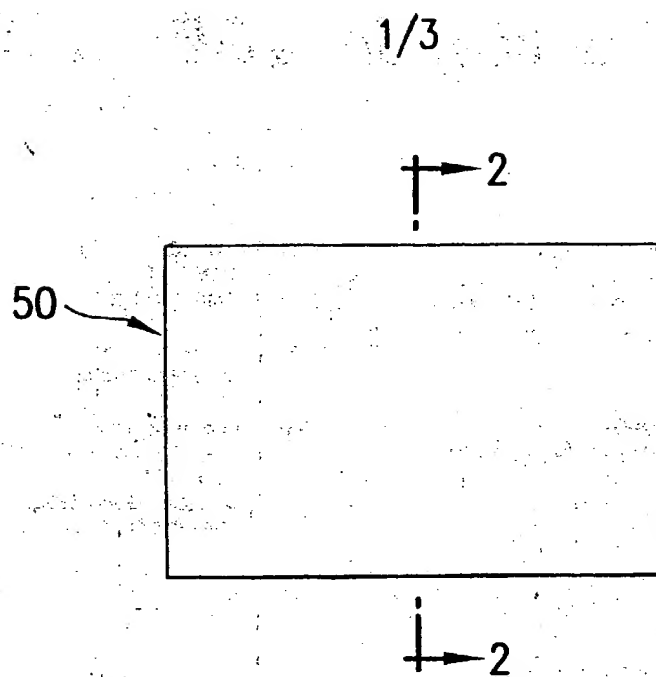


FIG. 1

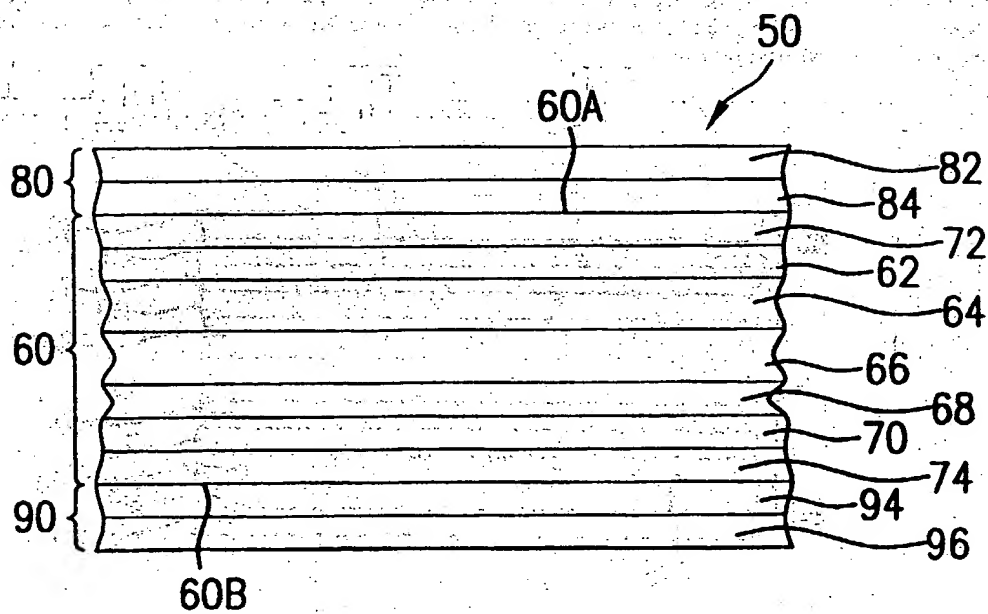


FIG. 2

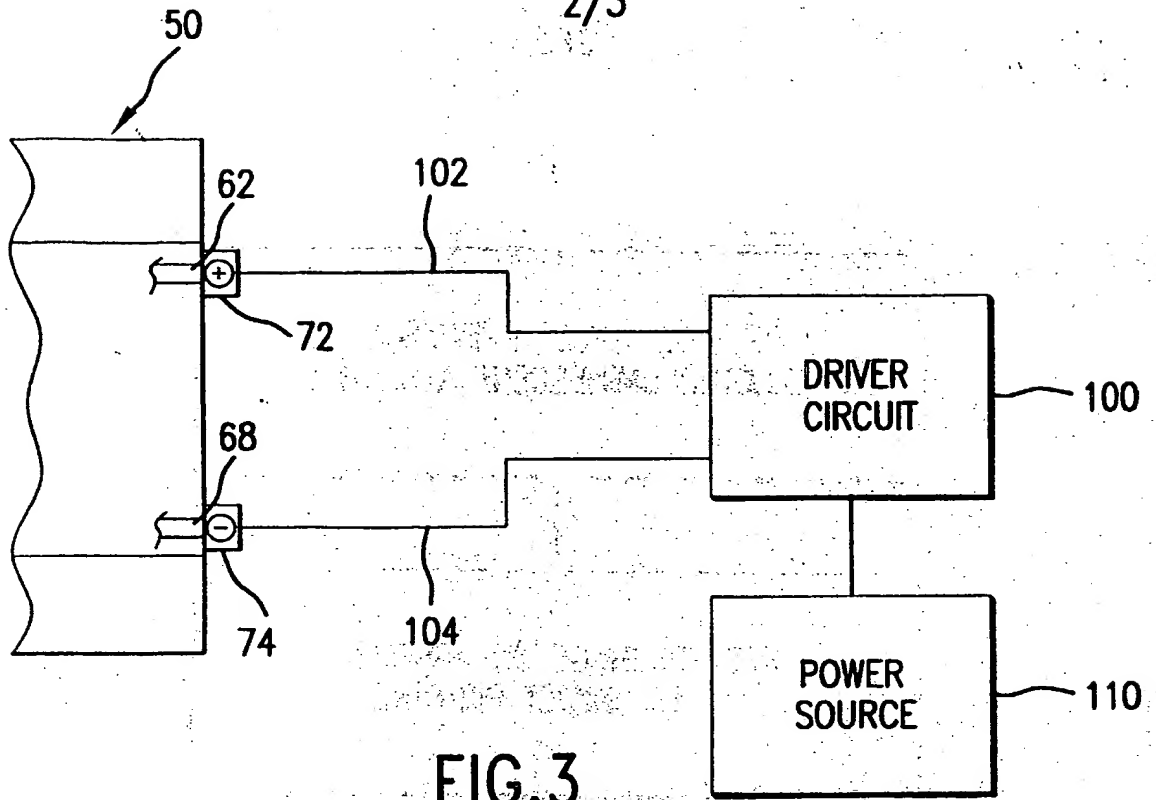


FIG. 3

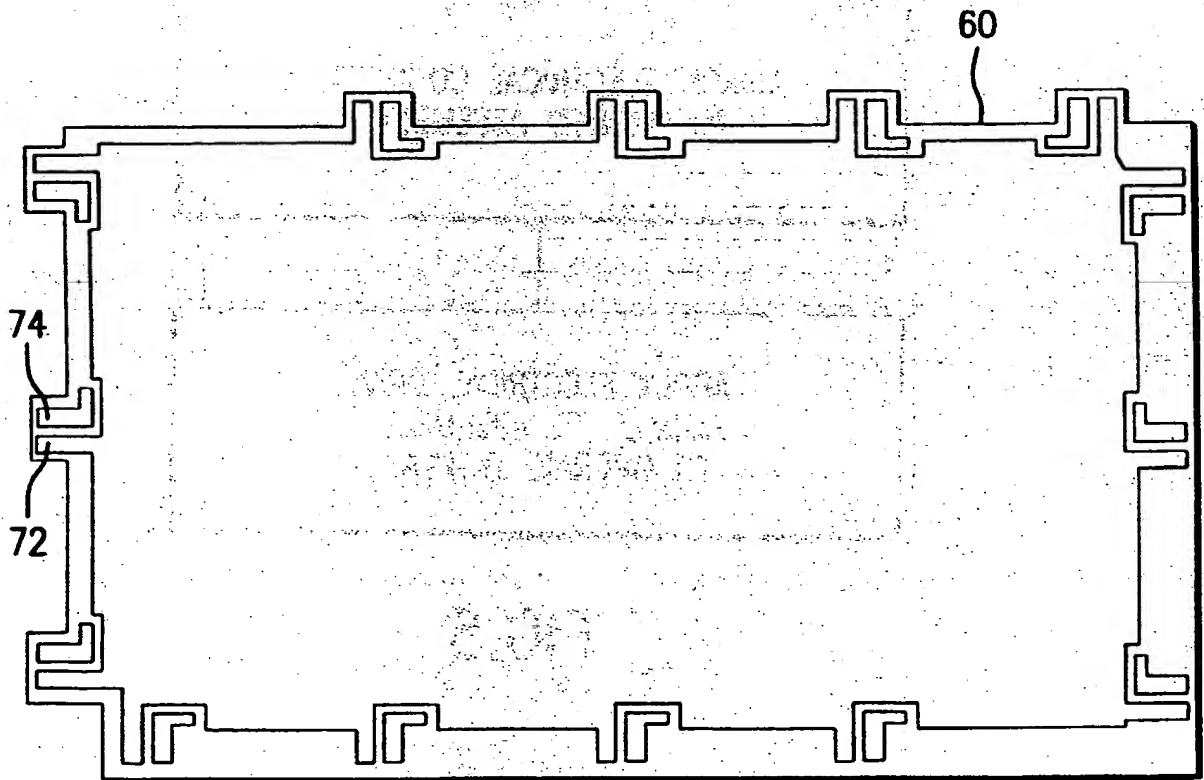


FIG. 4

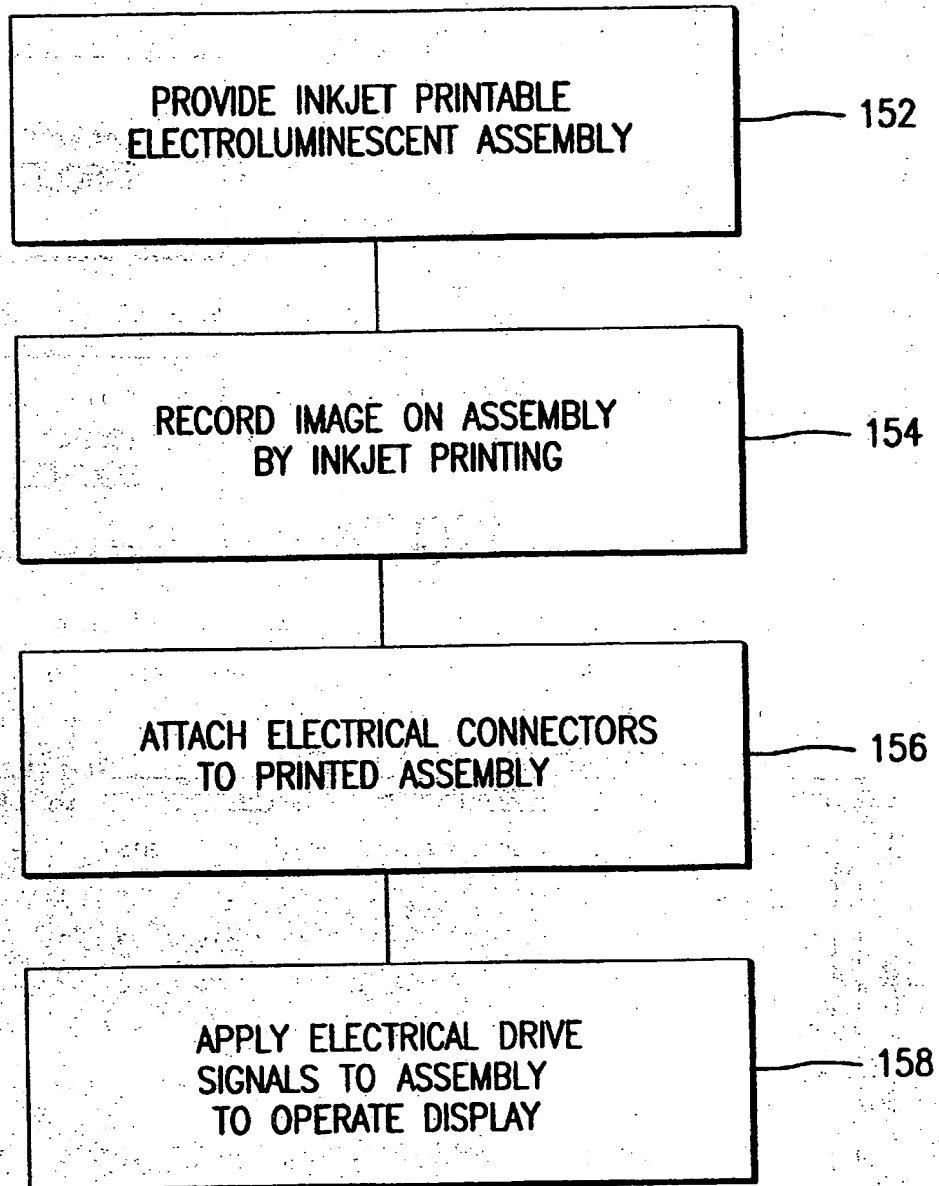


FIG.5

INKJET PRINTABLE ELECTROLUMINESCENT MEDIA

TECHNICAL FIELD OF THE INVENTION

This invention relates to printable media used in printing engines such as inkjet printers.

5

BACKGROUND OF THE INVENTION

Inkjet printing systems are in widespread use today. Ink jet printers print dots by ejecting very small drops of ink onto a print medium. In one typical application, a movable carriage supports one or more printheads each having ink ejecting nozzles. The carriage traverses over the surface of the print medium, and the nozzles are controlled to eject drops of ink at appropriate times pursuant to command of a microcomputer or other controller, wherein the timing of the application of the ink drops is intended to correspond to the pattern of pixels of the image being printed.

Color ink jet printers commonly employ a plurality of printheads, for example four, mounted in the print carriage to produce different colors. Each printhead contains ink of a different color, with the commonly used colors being cyan, magenta, yellow, and black.

Printing devices, such as inkjet printers, use printing ink to print text, graphics, images, etc. onto print media. The print media may be of any of a variety of

different types, sizes, side-specific coatings, etc. For example, the print media may include paper, transparencies, envelopes, photographic print stock, cloth, plastic, vinyl, special material, etc.

5

SUMMARY OF THE INVENTION

10 An electroluminescent media adapted for inkjet printing is described. An exemplary embodiment includes an electroluminescent substrate for generating light when excited by electrical drive signals, the substrate having a generally planar surface. An ink receiving layer is applied to the first surface, which allows recording of images during an inkjet printing process. The ink receiving layer is preferably transparent or translucent. A printer feedability controlling layer can optionally be applied to the second surface of the substrate to facilitate feeding the media through the inkjet printer.

20

BRIEF DESCRIPTION OF THE DRAWING

These and other features and advantages of the present invention will become more apparent from the following detailed description of an exemplary embodiment thereof, as illustrated in the accompanying drawings, in which:

25

FIG. 1 is a top plan view of an electroluminescent inkjet printable medium in accordance with the invention.

FIG. 2 is a schematic cross-sectional view taken along line 2-2 of FIG. 1.

30

FIG. 3 is a simplified schematic diagram of an exemplary electrical circuit arrangement for driving the electroluminescent media of the present invention.

FIG. 4 is a bottom view of an electroluminescent substrate which may be used in the assembly of FIG. 1.

35

FIG. 5 is a flow diagram illustrating a technique for fabricating and operating an electroluminescent display in

accordance with an aspect of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

5 An exemplary embodiment of an electroluminescent inkjet printable medium in accordance with the invention is illustrated in FIGS. 1 and 2. As shown in the top plan view of FIG. 1, the medium 50 is in the form of a sheet in a rectilinear shape, sized to feed through an inkjet
10 printer. FIG. 2 is a schematic cross-sectional view taken along line 2-2 of FIG. 1, and illustrates the structure of the medium 50. In a general sense, the medium comprises an electroluminescent substrate 60 having a top surface 60A and a bottom surface 60B. An inkjet coating 80 is applied
15 to the top surface 60A of the substrate 60, and receives the ink droplets ejected by the inkjet printing system to record thereon an image.

20 A feature of the coating 80 in a preferred embodiment is that it is a translucent or transparent coating, allowing illumination light generated by the substrate 60 to backlight the coating 80.

25 The substrate 60 includes, in an exemplary embodiment, a plurality of layers assembled together. The layers include a cathode layer 62, a dielectric layer 64, a phosphor layer 66, an anode layer 68, and a polyester film layer 70. Top and bottom water impervious protective layers 72, 74 can be applied to the cathode layer 62 and the film 70, respectively, if needed for particular substrate embodiments or applications. The inkjet coating
30 layer 80 is applied to the top layer of the substrate 60. Electroluminescent substrates suitable for the purpose as substrate 60 are commercially available, and include the substrate systems marketed by BKL, Inc., 421 Fehleley Drive, King of Prussia, PA 19406, as the Proto-Kut prototyping
35 panel, for use with the Proto-Kut demonstration kit.

 The inkjet coating 80 includes in an exemplary embodi-

ment a multi-layer composite, including an inkjet receptive top layer 82, and an adhesive enhancer layer 84, which can represent either a material layer or a process step. For example, the adhesive enhancer layer 84 can be a material layer which bonds layer 82 to the substrate 60. Exemplary materials which can be employed for layer 82 include gelatins and acrylics. Alternatively, the layer 84 can represent a process to bond the layer 82 to the substrate 60, e.g. a corona treatment that oxidizes the surface of the substrate 60.

Inkjet coatings suitable for use in the fabrication of the media 50 are known in the art. One exemplary transparent coating suitable for the layer 82 is described in U.S. 5,989,687. Another exemplary transparent coating suitable for layer 82 is the inkjet printable coating on the transparency films marketed by Hewlett-Packard Company (HP) as part number C3834A, HP Premium Inkjet Transparency Film. These transparent coatings should have haze according to ASTM D1003 of less than 20%, and preferably less than 10%, with light transmission according to ASTM D1003 greater than 80%, and preferably greater than 90%. A translucent coating suitable for the purpose is the coating on the film marketed in roll form by HP as part number C6778A, HP Colorluculent Backlit UV.

The inkjet coating 80 can be applied or attached to the substrate 60 by any suitable method for applying coatings to substrates. For example, many suitable coating techniques are described in Modern Coating and Drying Technology, edited by Edward Cohen and Edgar Gutoff, Wiley-VCH, 1992, e.g. Chapter 1, at pages 1-10, including slot coating, Meyer-rod coating and gravure coating processes. The coating material is applied in a liquid form to the top of the substrate 60, and dried or cured as part of the coating process.

An optional layer 90 can be applied to the bottom surface 60B of the electroluminescent substrate 60, to

facilitate feeding the coated substrate through an inkjet printer. The outer facing layer 96 is optionally adhered to the bottom surface 60B of the substrate by an adhesive enhancer represented by layer 94, which can be a layer of material such as a gelatin or acrylic, or a process for adhering the layer 96 to surface 60B. The outer layer 96 is a friction controlling surface or material. For example, the layer 96 can be a material used to reduce friction, such as wax or polyfluorinated polymers such as TEFLON (TM). Alternatively, the layer 96 can be used to increase friction, such as hydrophilic materials such as gelatin or polyvinyl alcohol.

In one exemplary embodiment, the electroluminescent substrate 60 has a thickness on the order of 250 microns, the inkjet coating 80 has a thickness on the order of 15 microns, and the back coat layer 90 has a thickness on the order of 1-10 microns.

The possible constructions of an inkjet printable electroluminescent media in accordance with the invention include the following. The electroluminescent substrate 60 is assembled to the inkjet coated substrate 80. The electroluminescent material can have on its backside a modification layer such as coating 90 to ensure the feedability of the assembly through the printing system.

Alternatively, the electroluminescent panel can be assembled first, and then subsequently applying both the inkjet receiving layers and feedability layers to the panel.

In all cases the necessary electrical contacts are defined to make the correct electrical connection to the assembly to excite the electroluminescence characteristics.

In operation, the media 50 is fed into the inkjet printer, either in sheet form or from a supply roll. While the media is fed under the control of the printer the printer creates the desired image using inkjet inks. After the creation of the image, the appropriate electrical

connectors are applied using tooling. These connectors allow for the connection of the necessary voltages and drive frequencies to drive the panel to light the image for display.

5 Thus, the electroluminescent medium 50 is configured to be passed through an inkjet printing system, and an image printed on the outer surface of the inkjet coating 80. Once the medium 50 has exited the printing system, electrical leads can be attached to the terminals which are
10 provided on the substrate 60 for connecting the electrical driver circuit for powering the substrate. FIG. 3 is a simplified schematic diagram of an exemplary electrical circuit arrangement. Terminals 72 and 74 are electrically attached to the respective cathode and anode layers 62, 68
15 of the substrate 60. A driver circuit 100 is connected to the terminals via wiring 102, 104. The driver circuit 100 is connected to a power source 110. The details of the driver circuit and power source will depend on the requirements for the particular electroluminescent substrate 60.
20 For example, for relatively small substrates, e.g. having a 5 inch by 8 inch lit area, a low voltage circuit can be used, and can be powered by a battery source. Relatively large substrates can be powered by a higher voltage circuit. The driver circuit in an exemplary application
25 converts DC voltage into a AC output for driving the substrate 60. Driver circuits suitable for the purpose are commercially available.

FIG. 4 is a bottom view of an electroluminescent substrate which may be used in the assembly of FIG. 1.
30 The terminals to which the electrical leads are attached are schematically illustrated here.

FIG. 5 is a flow diagram illustrating a technique for fabricating and operating an electroluminescent display in accordance with an aspect of the invention. The inkjet
35 printable substrate is provided at step 152, having an inkjet printable coating applied to one surface thereof.

Next, at step 154, an image is recorded on the coated substrate, using an inkjet printing technique. For example, the coated substrate may be passed through an inkjet printer/plotter, having a traversing carriage carrying printhead for ejecting multiple colors of ink droplets in a controlled manner on the substrate. After the image has been recorded on the substrate, at step 156, electrical connectors or leads are attached to the substrate to permit application of electrical drive signals. The display can then be operated (step 158) by applying the drive signals using a battery power source or a corded power supply connected to line power.

Thus, an electroluminescent assembly is described that can be fed into an inkjet printer and is capable of having high quality images printed on it. The assembly comprises an electroluminescent substrate for inkjet receiving layers and feedability controlling layers. The assembly can use intermediate adhesion layers or adhesion treatments in addition to the inkjet and feed controlling layers.

The invention can be employed in various applications, including providing relatively small backlit images such as photographs, or larger backlit images used in many different applications. Exemplary battery-powered and/or power cord-powered applications include custom imaged night-lights, custom imaged outdoor lights (e.g. family photographs, holiday scenes, etc.), stand-alone signage and displays that do not have access to power cords (such as point-of-sale displays), custom imaged directional signage/displays with battery backup in the case of power outages, and interior decoration such as custom imaged wall panels. The invention allows direct imaging of complex and photographic quality images for display. In the past, by contrast, electroluminescent panels have been used as the light source only and then an additional overlay with the image to be displayed/projected is created and assembled to the panels. The media in accordance with an aspect of this

inventions is feedable in inkjet printers to enable imaging. Improved image quality is provided because the image is a part of the assembly and directly in contact with the light emitting substrate. This optimizes the light's ability to illuminate the ink by reducing or eliminating scatter. Lower cost is achieved because the number of parts is reduced. Lower energy is required to achieve high quality images because the light does not have to go through an airspace and an additional substrate that is holding the image to be lighted/projected. Moreover, a display employing this invention can have longer life because the amount of energy needed to achieve the same image intensity is lower.

It is understood that the above-described embodiments are merely illustrative of the possible specific embodiments which may represent principles of the present invention. Other arrangements may readily be devised in accordance with these principles by those skilled in the art without departing from the scope and spirit of the invention.

CLAIMS

What is claimed is:

1. An electroluminescent medium (50) adapted for inkjet printing, including:

an electroluminescent substrate (60) for generating light when excited by electrical drive signals, the substrate having at least one generally planar surface (60A); and

an ink receiving layer (80) applied to the surface, the ink receiving layer for recording images applied during an inkjet printing process.

2. A medium according to Claim 1, further comprising:

a printer feedability controlling layer (90) applied to a second surface (60B) of said substrate to facilitate feeding the media through an inkjet printer.

3. A medium according to Claim 1 or Claim 2, further comprising electrical contacts (72, 74) to make an electrical connection to the electroluminescent substrate (60) to excite electroluminescence characteristics of the substrate.

4. A medium according to any preceding claim, wherein the ink receiving layer (80) is transparent or translucent to permit some light generated by the electroluminescent substrate (60) to pass through the ink receiving layer.

5. A medium according to Claim 4, wherein the ink receiving layer (80) has a light transmission characteristic greater than 80%.

6. A medium according to Claim 4, wherein the ink receiving layer (80) has a light transmission characteristic greater than 90%.

7. A method for fabricating and using an electroluminescent inkjet printable medium (50), comprising:

providing an electroluminescent substrate (60) for generating light when excited by electrical drive signals, the substrate having at least one surface (60A) with an ink receiving coating (80) applied to the surface;

recording an image on the ink receiving coating (80) by inkjet printing; and

exciting the electroluminescent substrate (60) with said electrical drive signals to cause the substrate to generate light and operate the media.

8. A method according to Claim 7, wherein:

the step of providing the substrate (60) includes providing the substrate having a printer feedability controlling layer (90) applied to a second surface (60B) of said substrate to facilitate feeding the media through an inkjet printer; and

the step of recording an image includes feeding the substrate through the printer during the inkjet printing.

9. A method according to Claim 7 or Claim 8, wherein the ink receiving coating (80) is transparent or translucent to permit some light generated by the electroluminescent substrate to pass through the ink receiving layer.

10. A method according to any preceding claim, further comprising:

applying electrical connectors (72,74) to the substrate (60); and

wherein the step of exciting the substrate includes passing said electrical drive signals through said electrical connectors.



INVESTOR IN PEOPLE

Application No: GB 0200500.7
Claims searched: 1-10

Examiner: A J Rudge
Date of search: 29 April 2002

Patents Act 1977 Search Report under Section 17.

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): B6C(CBPC, CSSA, CST); B6F(FAN), H1K(KEAM)

Int Cl (Ed.7): H05B 33/00; H01L 51/20, 51/30

Other: Online databases: EPODOC, JAPIO, WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	JP2000208279 A (KANDA BIJUTSUSHA KK) - see abstract provided	1 at least
A	JP2001277490 A (SEIKO EPSON CORP)	

X Document indicating lack of novelty or inventive step
Y Document indicating lack of inventive step if combined with one or more other documents of same category.
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A Document indicating technological background and/or state of the art.
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